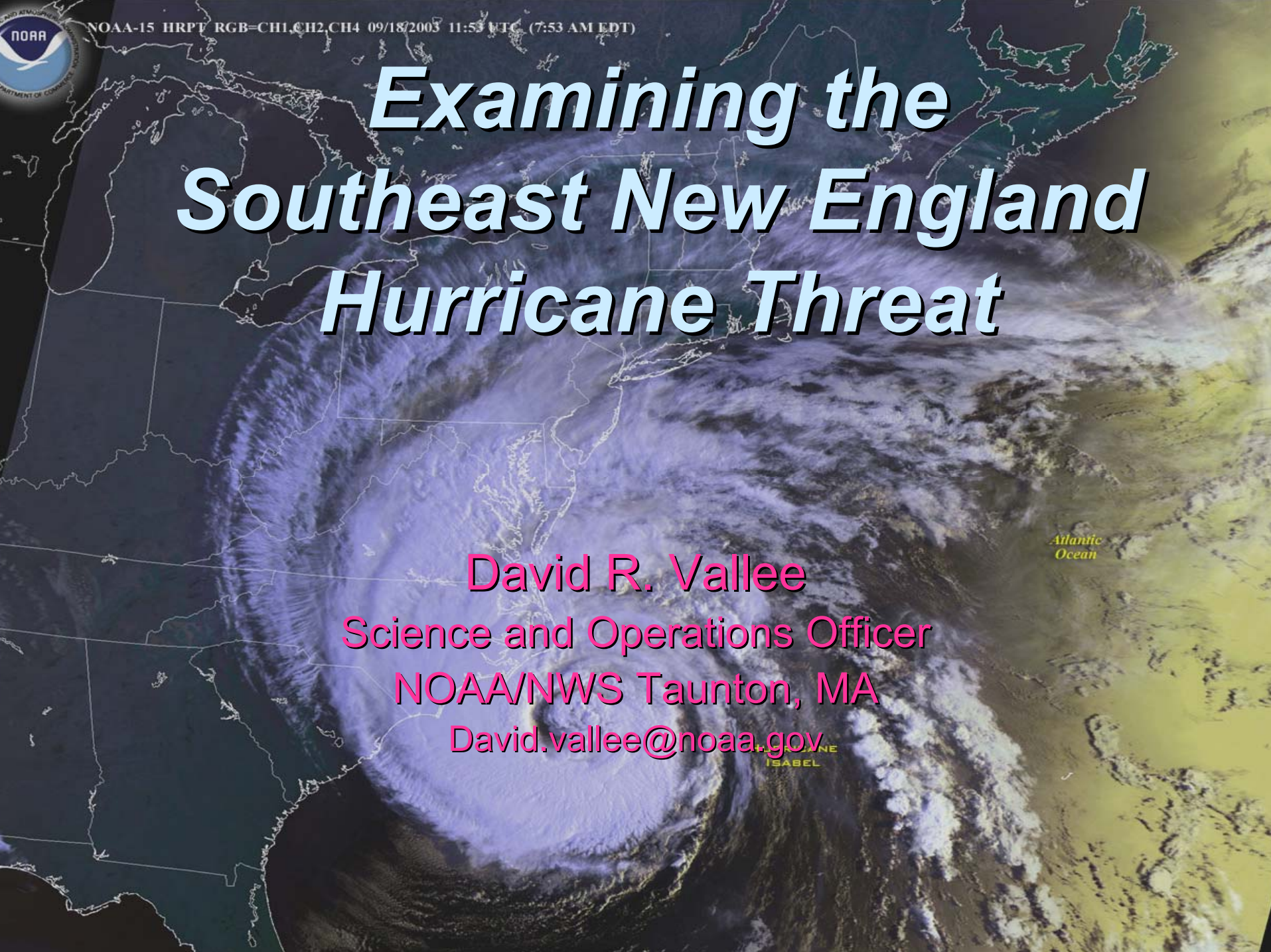


Examining the Southeast New England Hurricane Threat

David R. Vallee
Science and Operations Officer
NOAA/NWS Taunton, MA
David.vallee@noaa.gov

Objectives

- Understand the behavior / history
- Recognize the hazards
- Significant issues

Hurricane Edition

THE WESTERLY SUN

Local and Shore News

Vol. 46. No. 39 WESTERLY, R. I., FRIDAY SEPTEMBER 23, 1938 Price Three Cents

Misquamicut Wiped Out; Napatree Point Gone; 50 Dead; Scores Missing

Westerly Paralyzed by Tropical Hurricane; Cottages at Charlestown Beach and Quonochontaug Washed Away; 4 Dead, 4 Missing In Stonington

Misquamicut with 500 cottages, was entirely wiped out, all cottages on Napatree Point, Watch Hill, destroyed and more than 50 people killed and millions of dollars of property damage resulted from a tidal wave and hurricane which struck Westerly late Wednesday afternoon.

Charlestown Beach and Quonochontaug likewise were destroyed.

Westerly and the Rhode Island shore received the brunt of the force in New England, more deaths being reported in this locality than any other.

Records show that just 123 years ago to the day, September 21, a hurricane struck Westerly.

Pawcatuck Overflows

The ocean backed up the Pawcatuck River causing it to flood the

List of Dead and Missing

Bodies Recovered

Mrs. Henry Bennett, New York City
Mrs Ella Bliven
Mrs. Ralph Bliven, Misquamicut
Mrs. George Bradley
Mrs. Byron Button
Mrs. R. N. Byrnes
Mrs. George P. Clark, Shannock
Miss Harriet Clark, Shannock
Miss Ann Clark, Shannock
Miss Florence Clark, Shannock
Mrs. Philip Clemens
Mrs. Lloyd M. Cook
George Cross, Charlestown
Mrs. George Davidson
Mrs. Dunmore
Mrs. Zoe Fleicher
Father Fitzgerald
Mr. James Gould
Mrs. Kingsbury
Mrs. Rayback
Evelyn Bliven
Mr. Bunce
Ethel Crooker
Frank Fassetti
Mrs. John Davidson
Amos Burdick
Mrs. Amos Burdick
B. L. Lamphear
Mrs. Mead and two children
Mrs. William Bliven
Two small Moriarty children
Mrs. F. Hopley
Agnes S. Herrick
Catherine Culley
Della O'Toole
Frances O'Toole
Ethel Avery

Every one of the approximately 200 houses on Charlestown Beach was carried away.

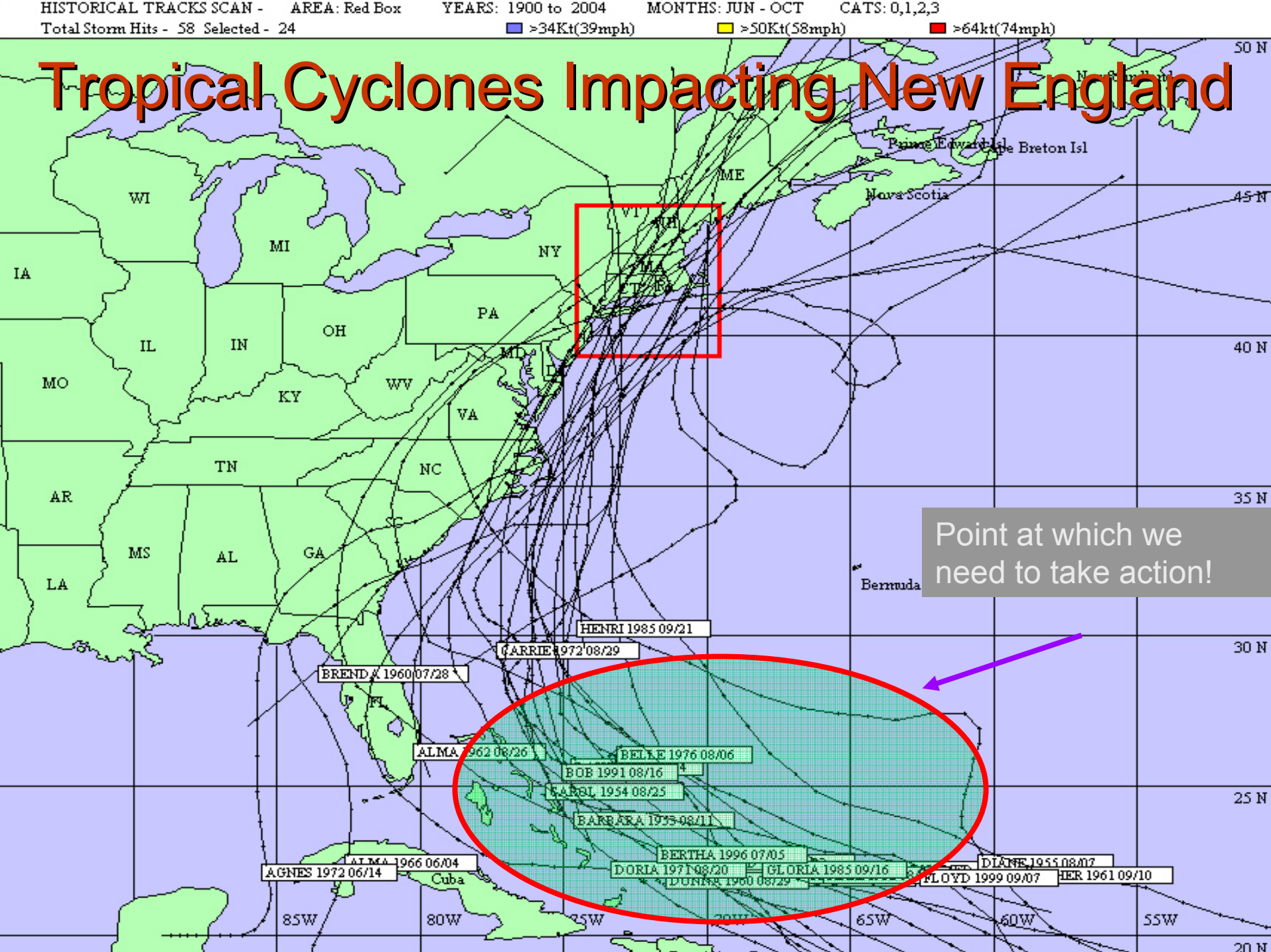
Between 75 and 100 houses on the Charlestown Pond area including Charlestown-by-the-Sea were demolished. The few houses left in that area have been moved from a few feet to a quarter of a mile away. A few houses on hill pastures are not so badly damaged. Many people who were staying in that section just barely escaped.

Mrs. David Larkhan and daughter who were on the beach started across the Pond on a door. Mrs. Larkhan washed away, but Miss Larkhan was saved, although she is in a poor condition.

Mr. Mee and family were in their car, leaving the beach, and stopped to assist the Breckinridge family who were in trouble. The wave

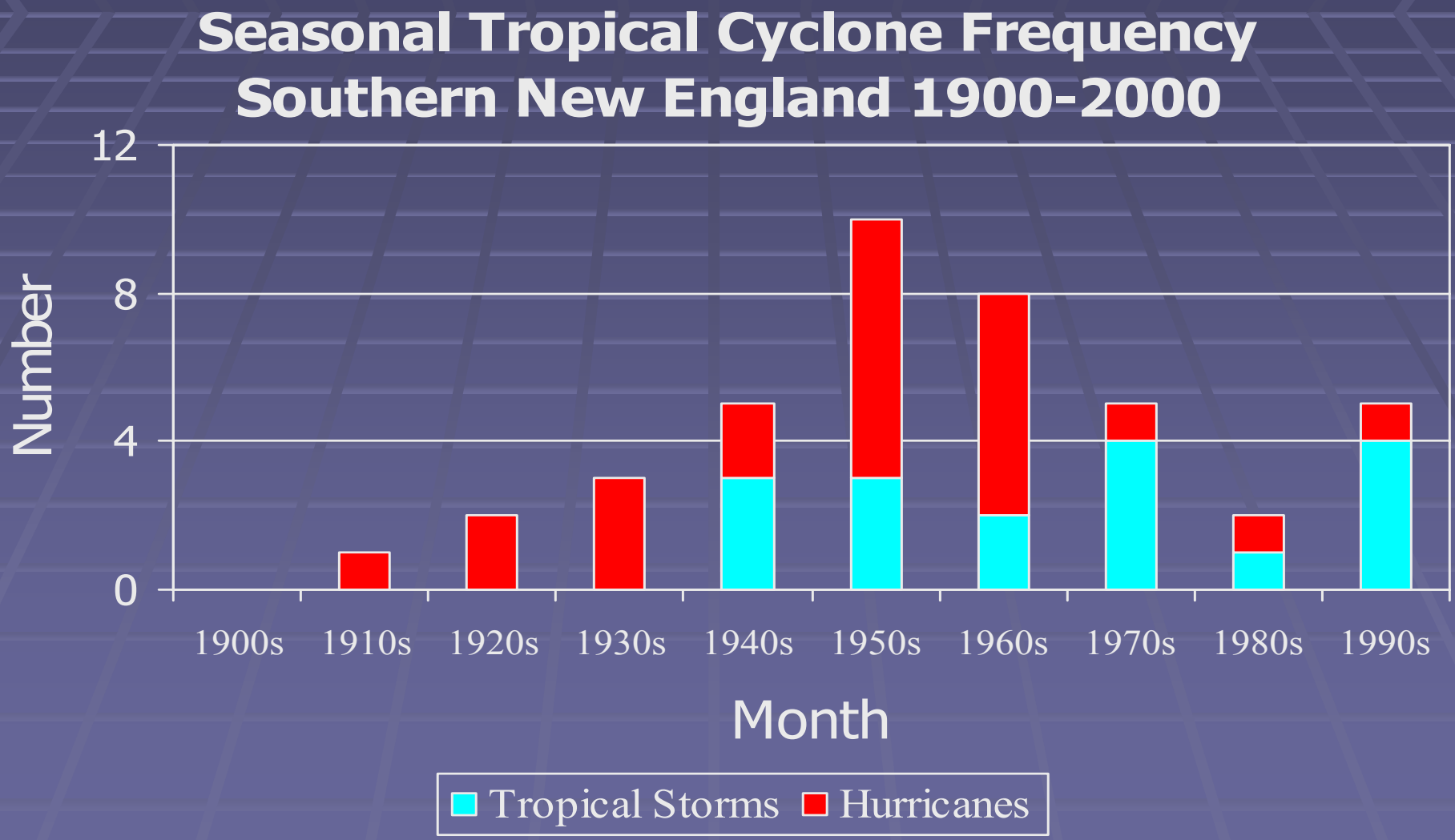
Low Frequency but High Impact!

- Southern New England has experienced tremendous impact from tropical cyclones.
- Twelve major land falling storms 1900-2005.
  - Significant damage produced by high winds, storm surge and heavy rains.
  - 47 systems came close enough to impact the region with a period of high wind, coastal flooding, or heavy rainfall.
- Four Category 3 Hurricanes in a 16 year period.
  - Great New England Hurricane of 1938
  - Great Atlantic Hurricane of 1944
  - Carol and Edna, Summer of 1954


HISTORICAL TRACKS SCAN - AREA: Red Box YEARS: 1900 to 2004 MONTHS: JUN - OCT CATS: 0,1,2,3
Total Storm Hits - 58 Selected - 24
>34Kt(39mph)
>50Kt(58mph)
>64kt(74mph)
Tropical Cyclones Impacting New England
Point at which we need to take action!
WI
MI
IA
IL
IN
OH
MO
KY
WV
PA
NY
VT
NH
ME
MD
VA
TN
NC
AR
MS
AL
GA
LA
FL
Cuba
Bermuda
Nova Scotia
Prince Edward Isl
Cape Breton Isl
HENRI 1985 09/21
CARRIE 1972 08/29
BRENDA 1960 07/28
ALMA 1962 08/26
BELLE 1976 08/06
BOB 1991 08/16
CAROL 1954 08/25
BARBARA 1953 08/11
BERTHA 1996 07/05
DORIA 1971 08/20
GLORIA 1985 09/16
DUNNA 1960 08/29
DIANE 1955 08/07
FLOYD 1999 09/07
HER 1961 09/10
AGNES 1972 06/14
ALMA 1966 06/04
50 N
45 N
40 N
35 N
30 N
25 N
20 N
85W
80W
75W
70W
65W
60W
55W

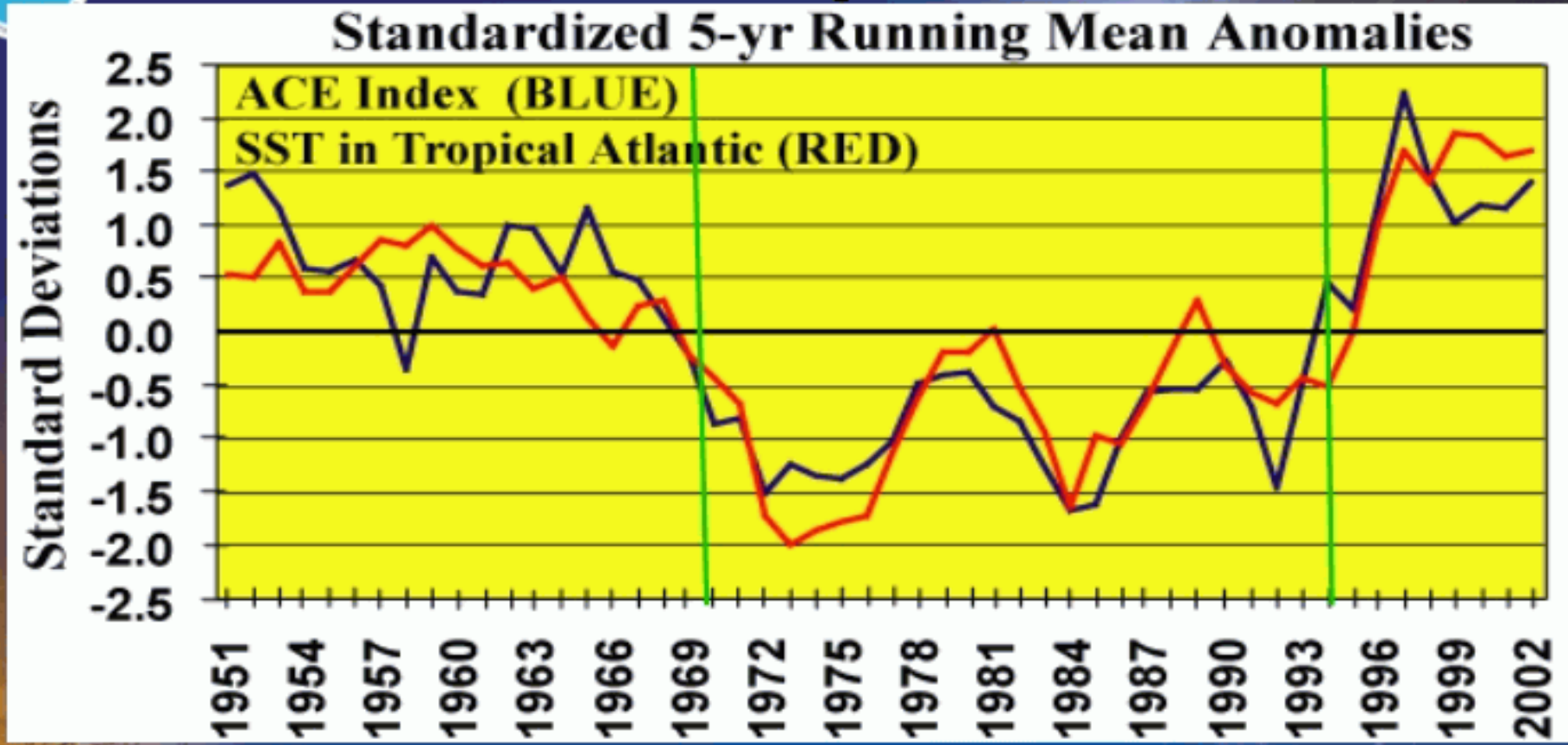
Active vs. Inactive Periods

1930s-1950s active vs. 1970s-1980s inactive



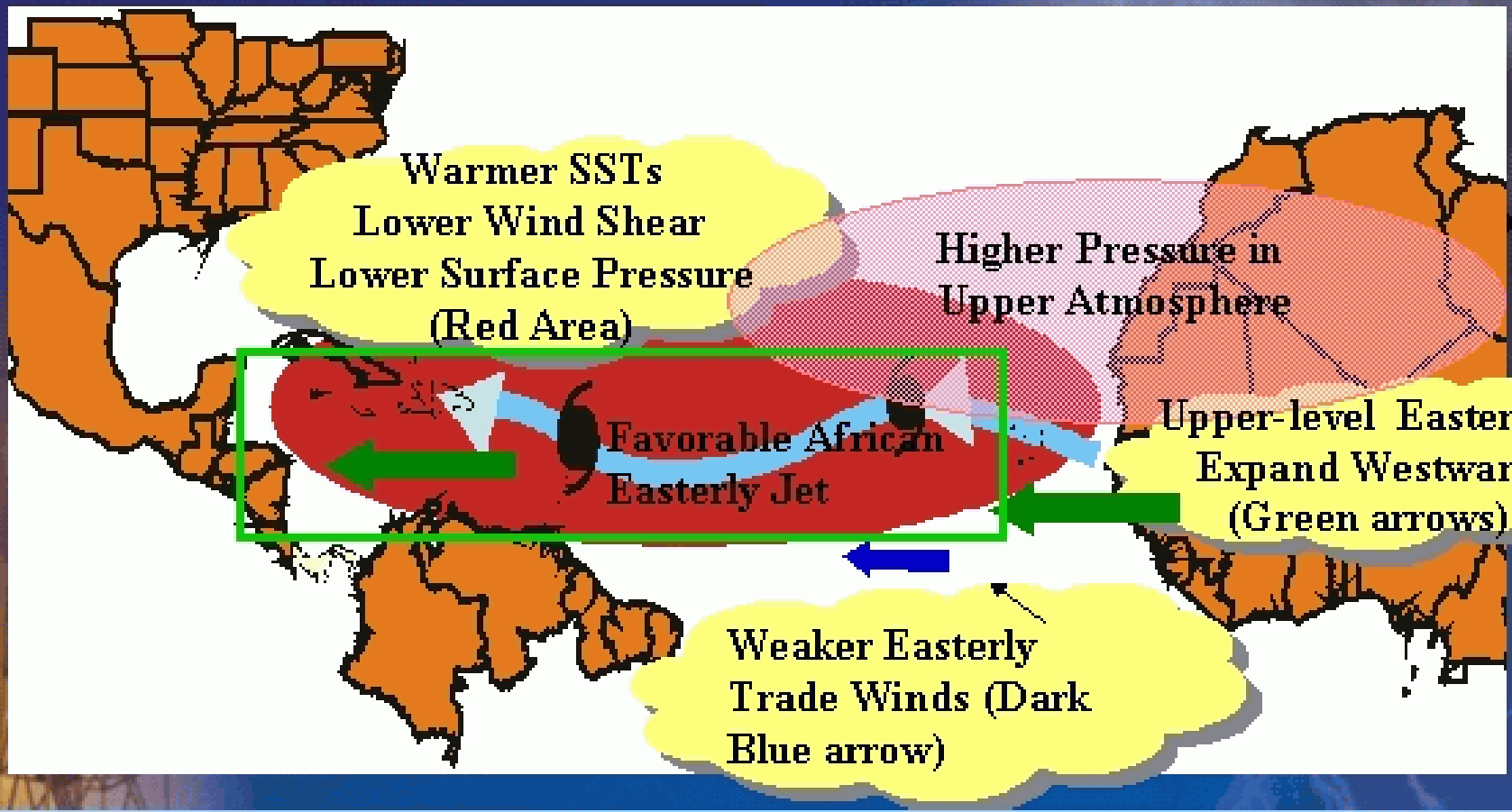
No coincidence that the 1930s-50s were so active!

Multi-Decadal Signal in the Atlantic
ACE index and Tropical Atlantic SSTs



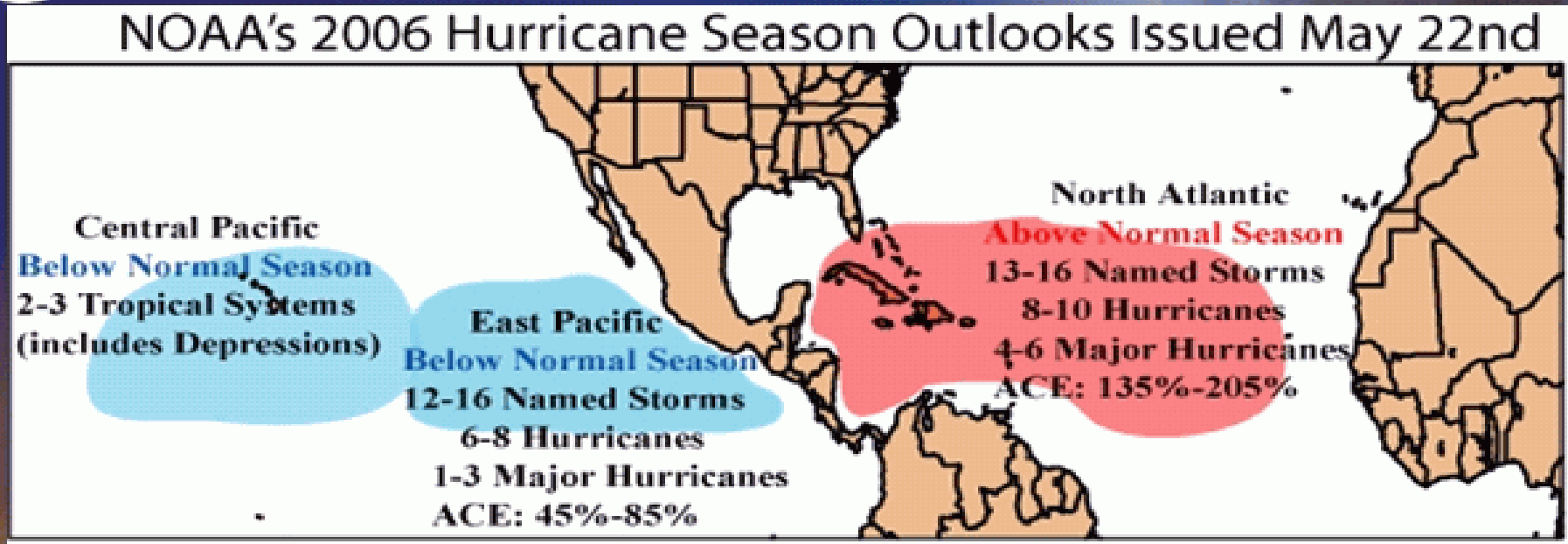
Since 1995, warmer tropical Atlantic SSTs (Red curve) have been associated with above-normal Atlantic hurricane activity indicated by NOAA's ACE index (Blue curve). Departures are plotted with respect to the 1951-2000 base period means.

Regional North Atlantic Conditions associated with the Multi-Decadal Signal



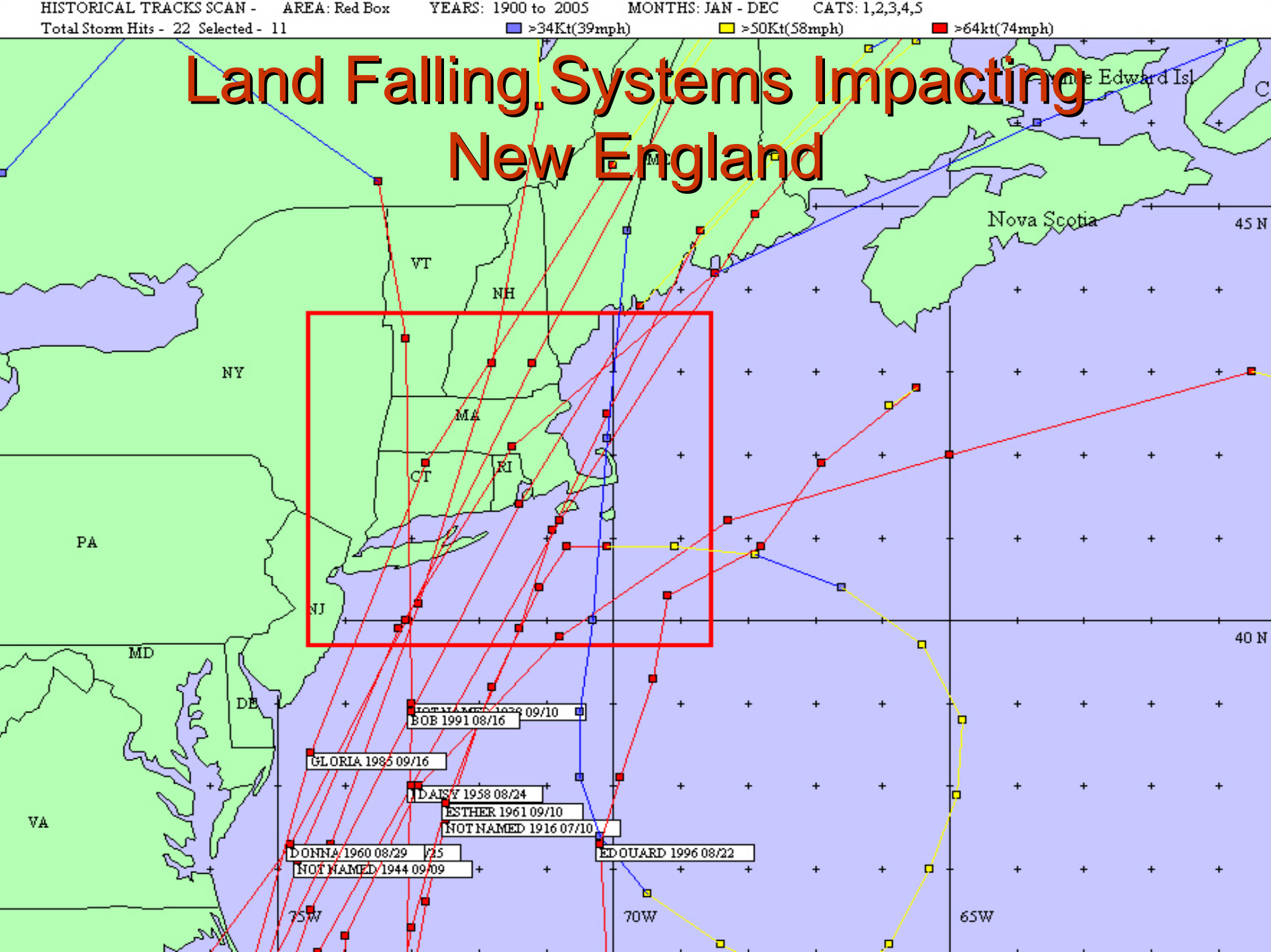
Expected conditions during July-October 2006 are strongly associated with the ongoing multi-decadal signal.

What to expect in 2006?



NOAA's seasonal hurricane outlooks, with the shaded areas indicating the main regions where tropical depressions, tropical storms, and hurricanes usually form. The outlooks indicate a 80% chance of an above-normal Atlantic hurricane season, and an 80% chance of a below-normal East Pacific hurricane season. Also, they indicate a below-normal hurricane season for the Central Pacific.

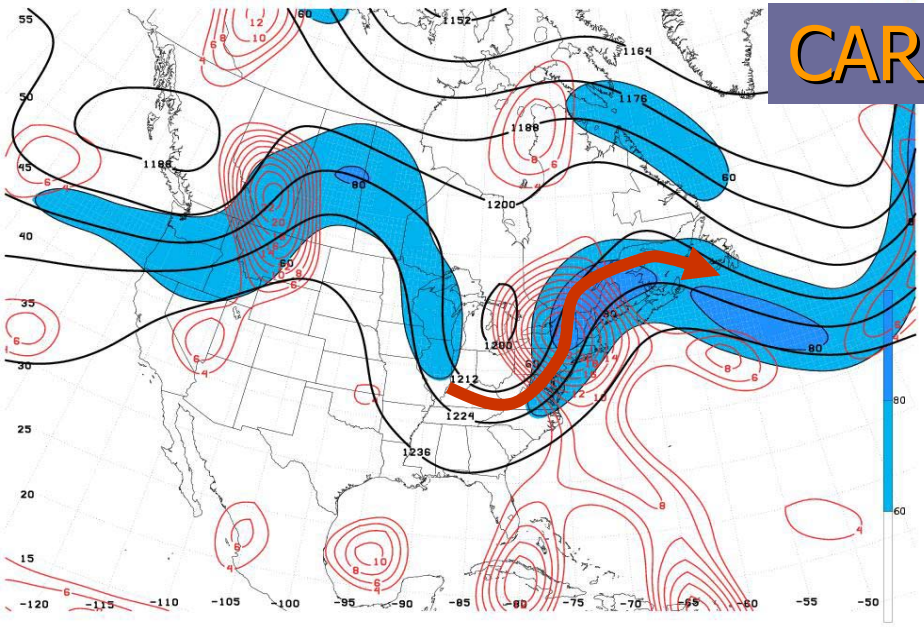
But for New England – the number of storms isn't that important. It's the "Prevailing Theme" of the weather pattern that will ultimately determine our vulnerability!

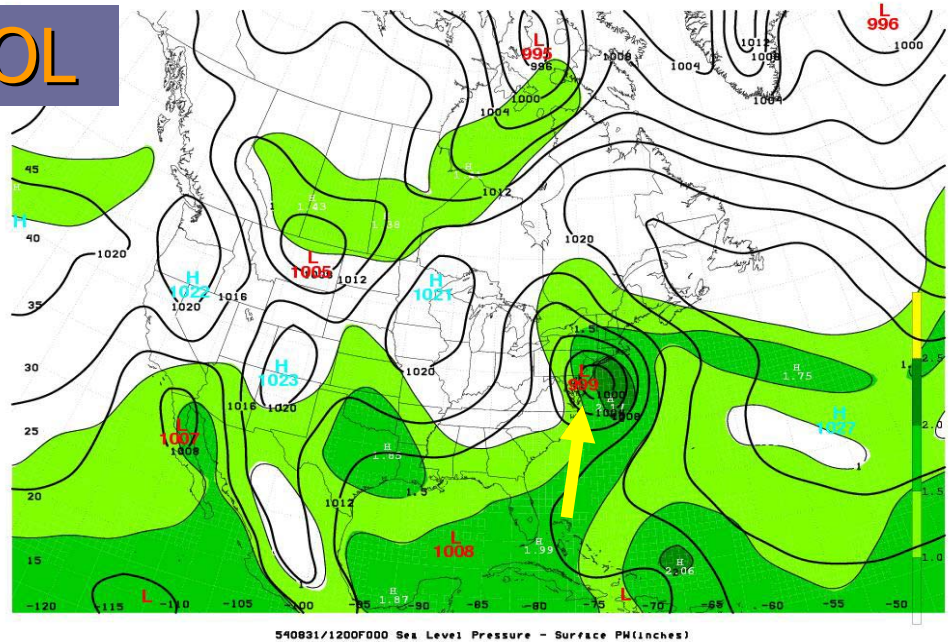

HISTORICAL TRACKS SCAN - AREA: Red Box YEARS: 1900 to 2005 MONTHS: JAN - DEC CATS: 1,2,3,4,5
Total Storm Hits - 22 Selected - 11
>34Kt(39mph)
>50Kt(58mph)
>64kt(74mph)
Land Falling Systems Impacting New England
Nova Scotia
VT
NH
NY
MA
CT
RI
PA
NJ
MD
DE
VA
45 N
40 N
75W
70W
65W
BOB 1991 08/16
GLORIA 1985 09/16
DAISY 1958 08/24
ESTHER 1961 09/10
NOT NAMED 1916 07/10
DONNA 1960 08/29
NOT NAMED 1944 09/09
EDOUARD 1996 08/22

Common Characteristics

- Rapid acceleration up the coast
  - Average speed – 33 mph as they raced through
- Heavy rainfall usually focused along and west of the storm track
  - Nearly ½ of the storms produced river/small stream flooding!
- High winds focused east of the track
- Storm surges focused east of the track

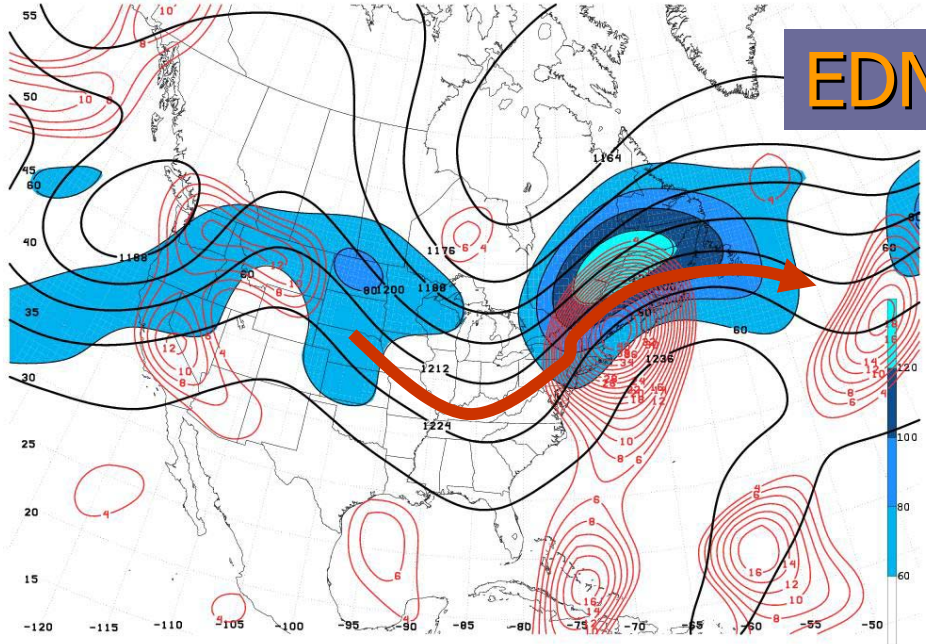
CAROL

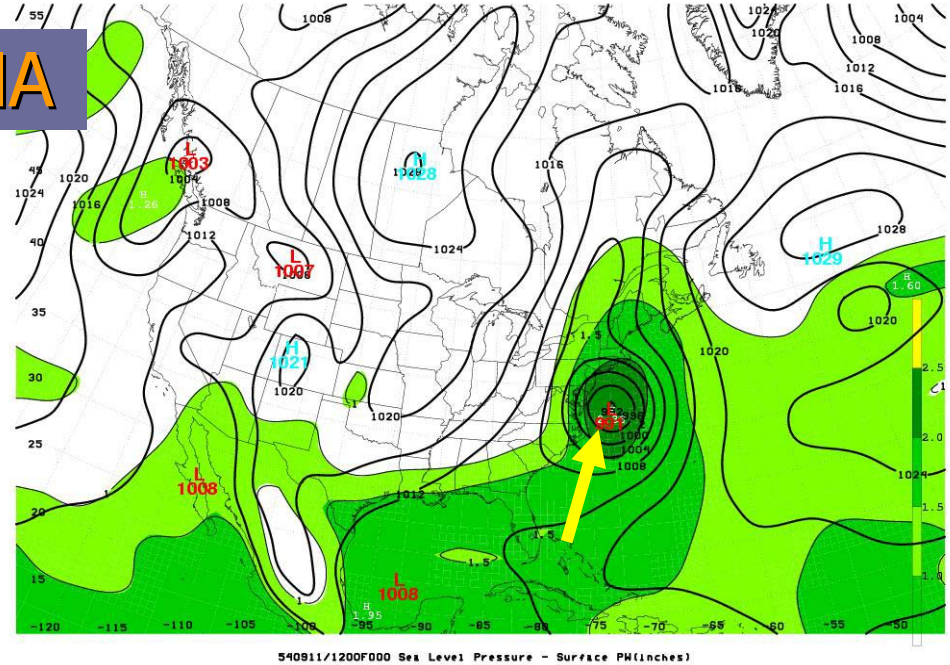




These are very "un-summerlike" weather patterns!

EDNA



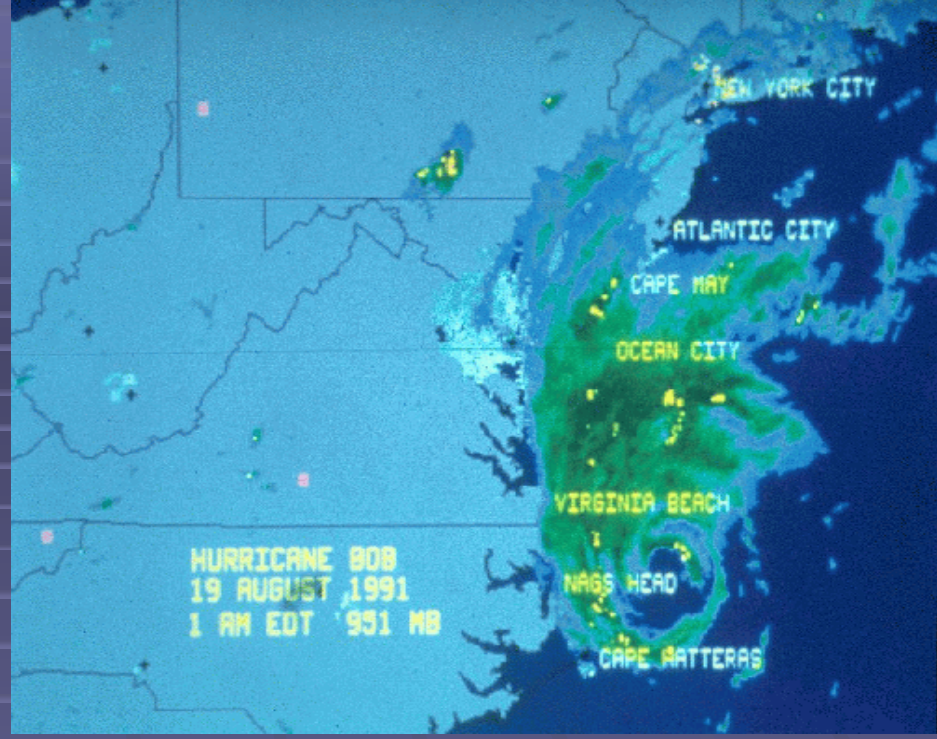


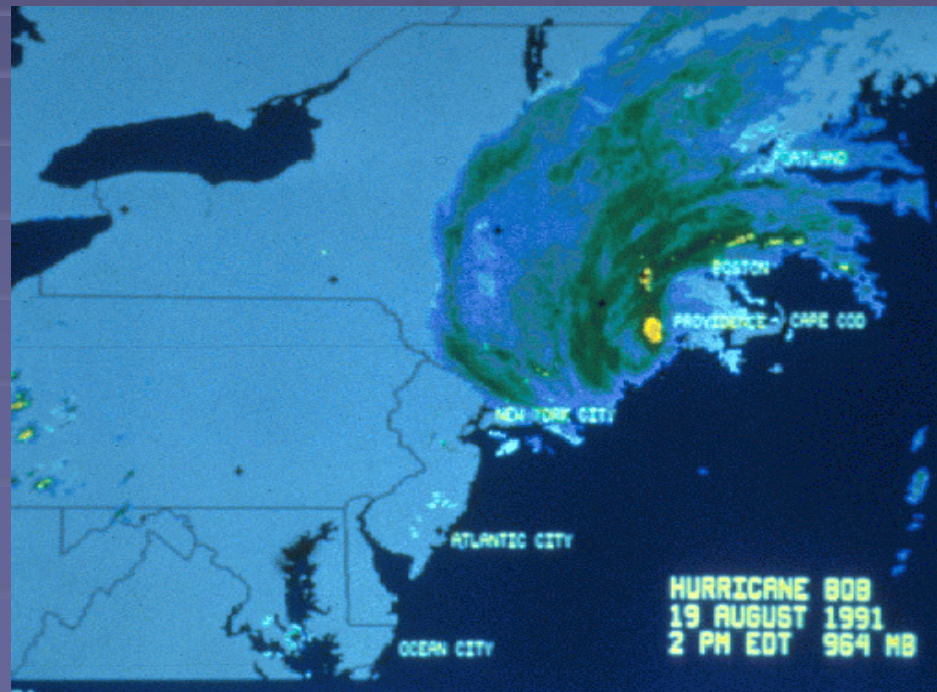
Rainfall – well in advance

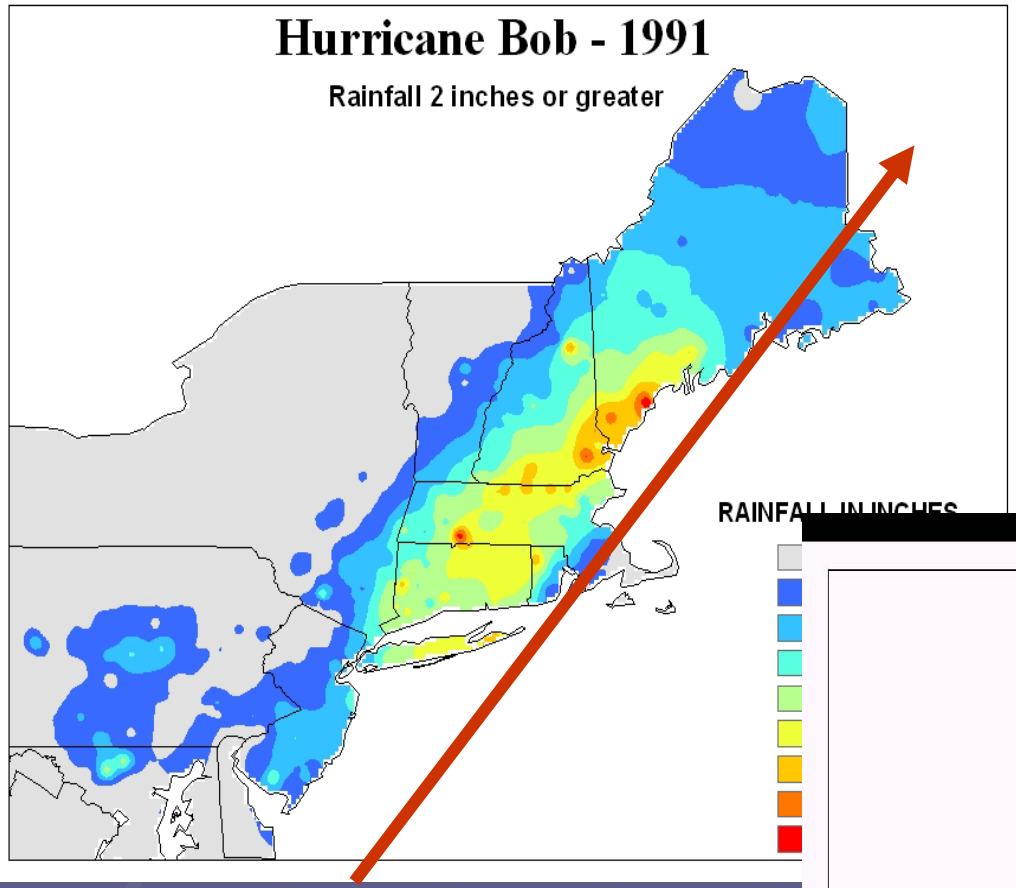
- Heavy rainfall will precede the height of the hurricane by 12-15 hours
- Nearly ½ of our storms since 1900 have produced river and flash flooding
- Dam failures have occurred
  - Life threatening situation
  - Very difficult to warn for

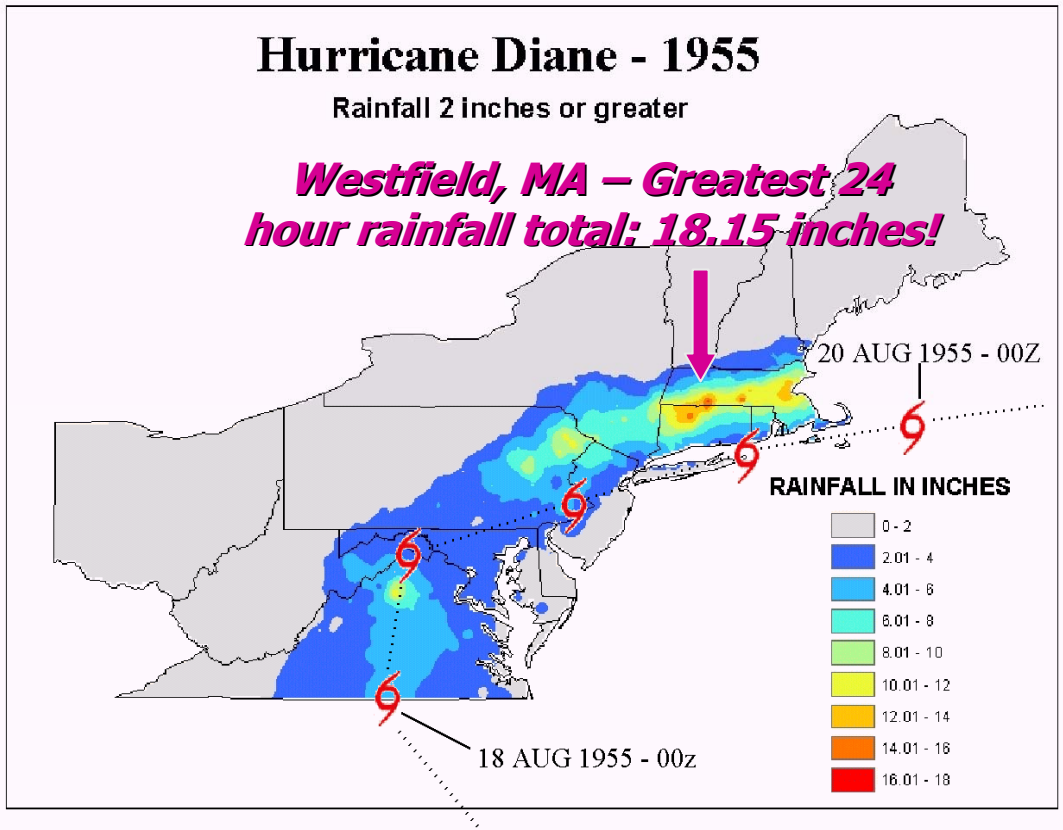
Hurricane Bob – 1991:

- Our hurricanes are trying to become winter-like
  - Rainfall shifting to west side
- Nearly ½ of our 43 storms since 1900 produced major river/stream flooding
- Average rainfall west of the track is 6-8 inches!



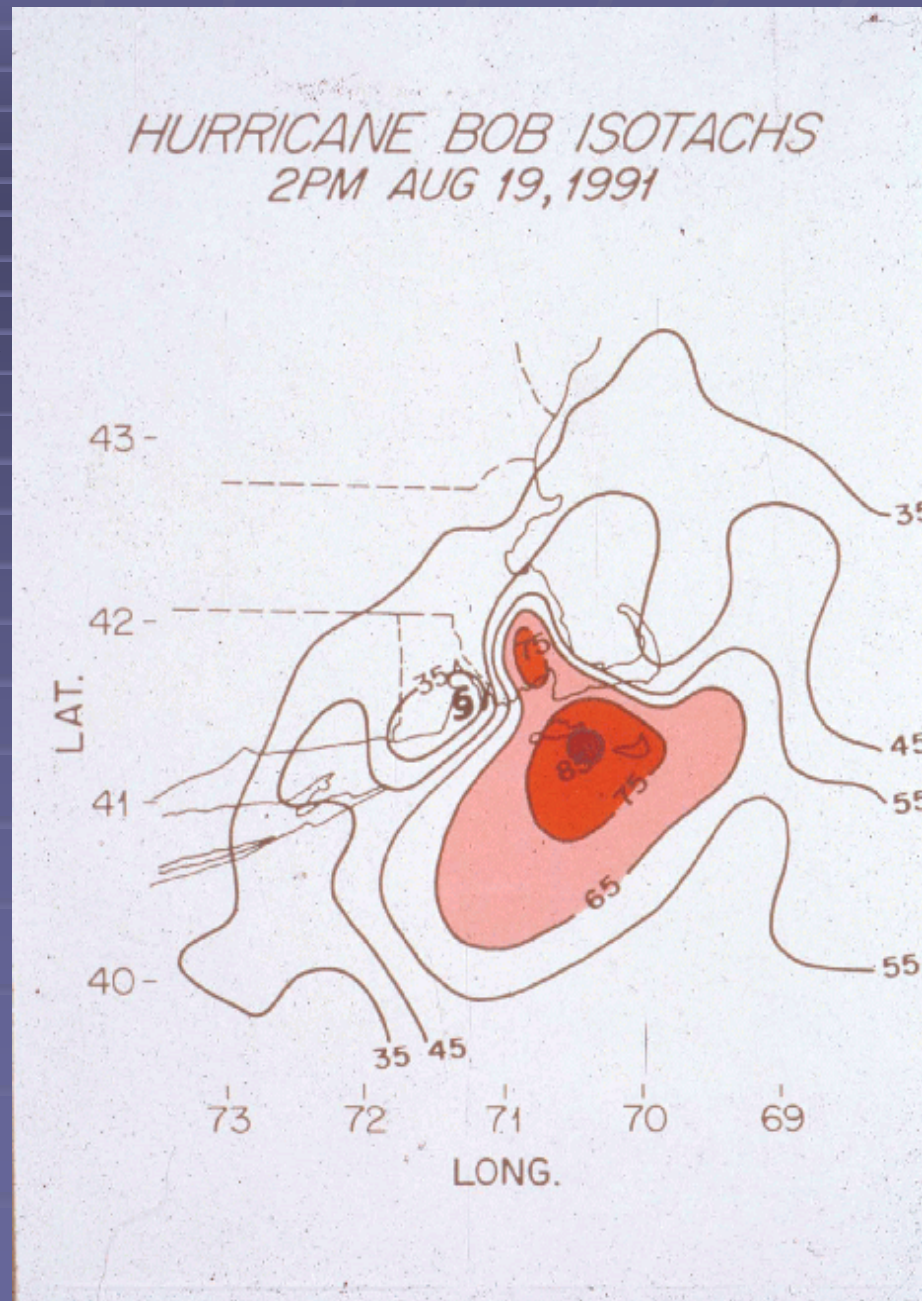



Hurricane Bob - 1991
Rainfall 2 inches or greater
RAINFALL IN INCHES


Hurricane Diane - 1955
Rainfall 2 inches or greater
Westfield, MA – Greatest 24 hour rainfall total: 18.15 inches!
20 AUG 1955 - 00Z
18 AUG 1955 - 00z
RAINFALL IN INCHES
0 - 2
2.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
10.01 - 12
12.01 - 14
14.01 - 16
16.01 - 18

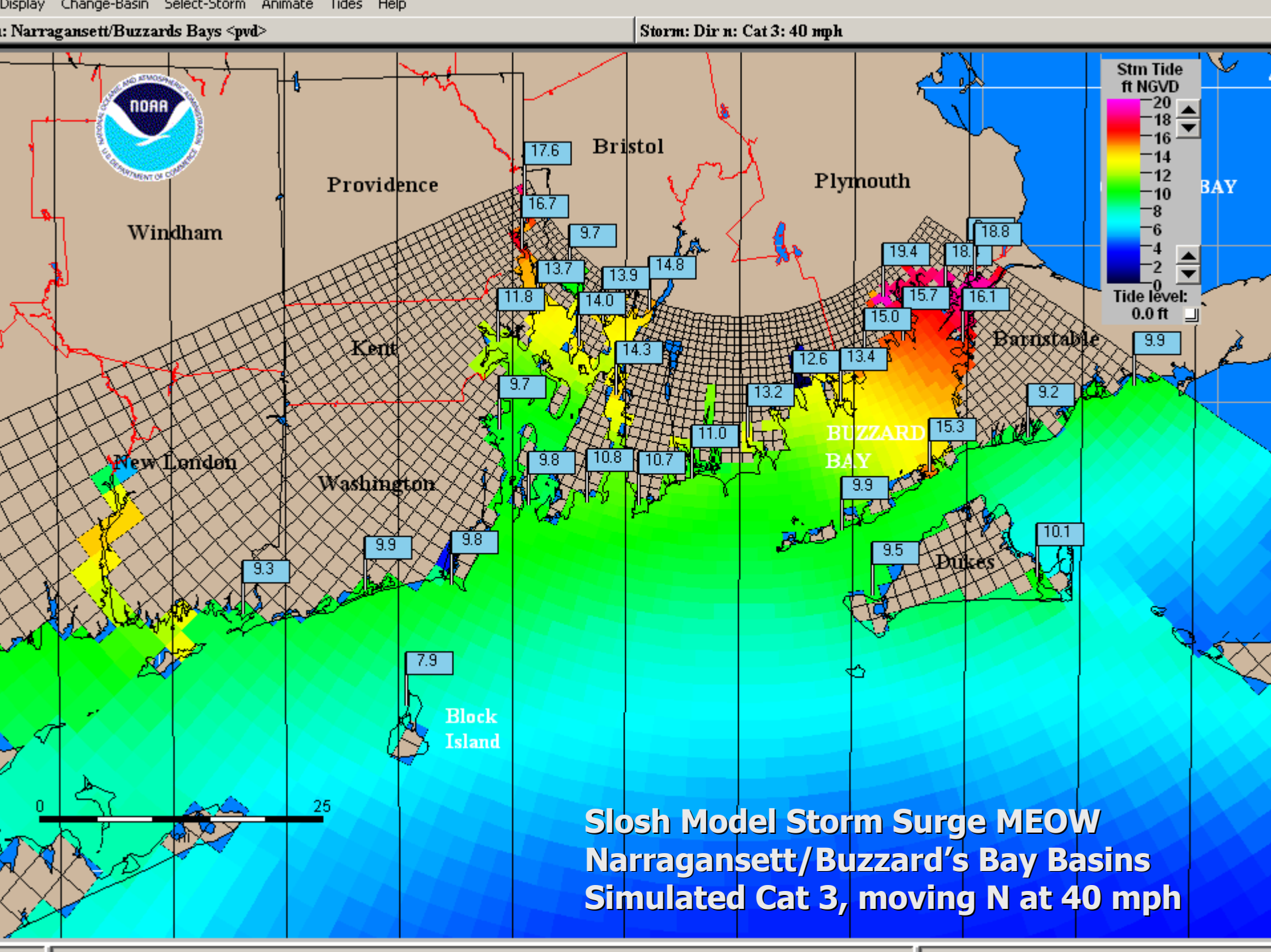
High Winds

- Radius of maximum winds (RMW) varied considerably
  - As small as 25 mi in Hurricane Bob 1991
  - As large as 60 nm in the Great New England Hurricane 1938
- Where this core goes will determine
  - Where wind damage will be the greatest
  - Where storm surges will be the highest

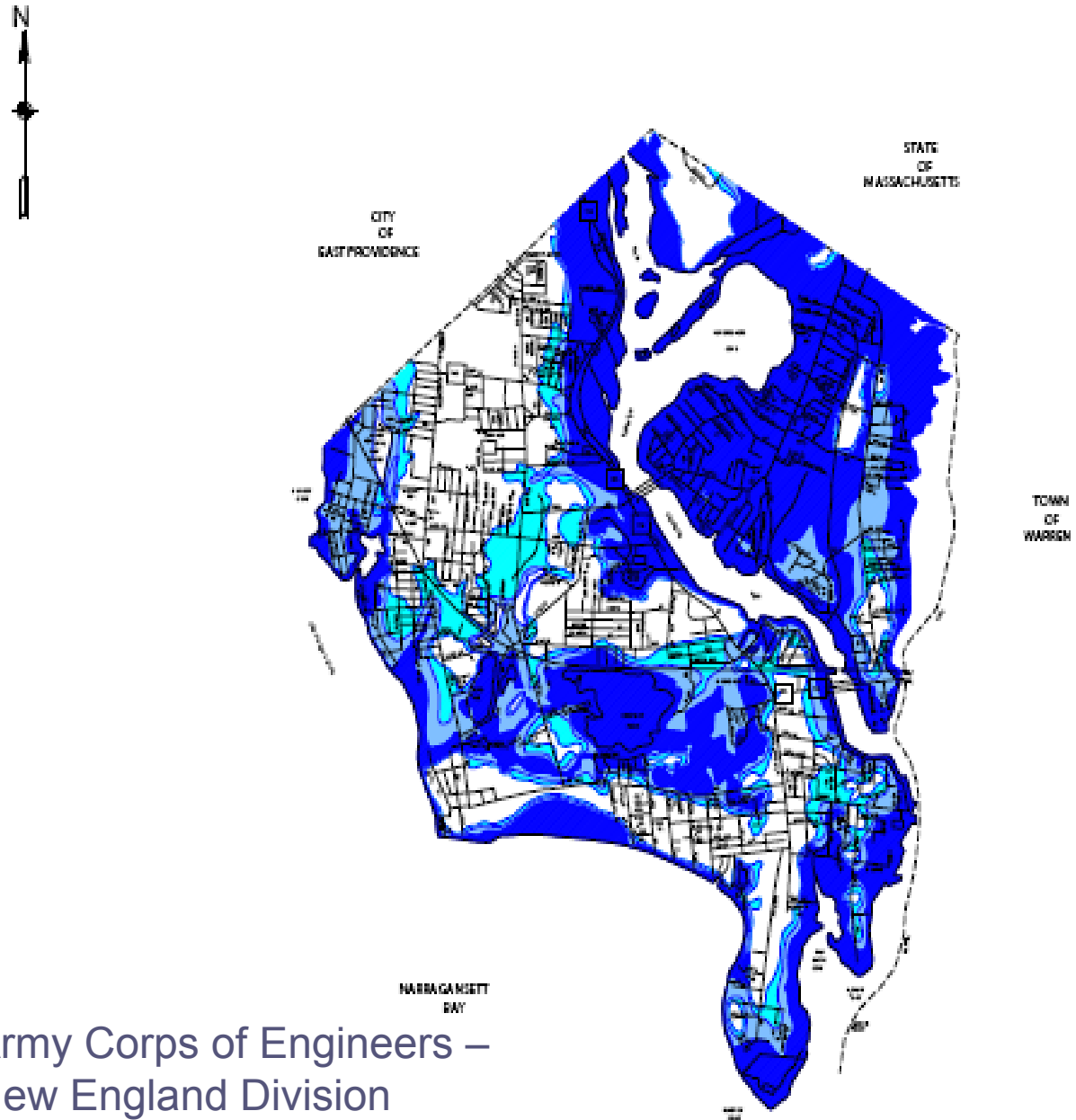


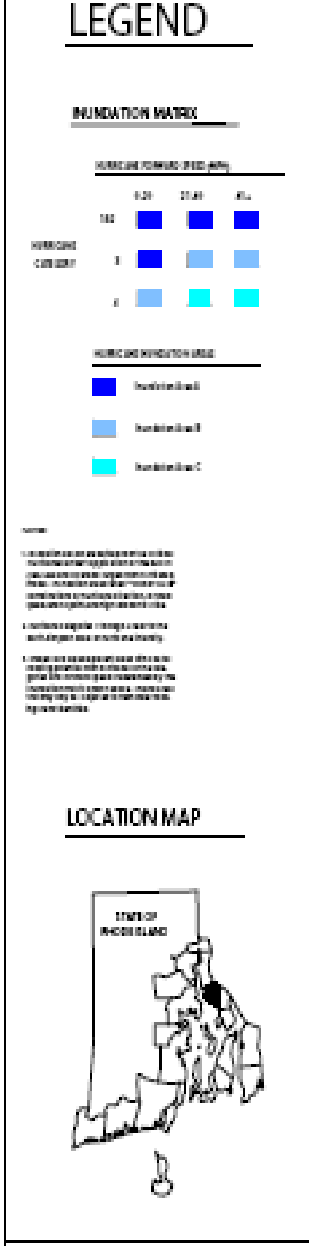
Storm Surge Characteristics

- Tremendous storm surges on south facing bays with the most significant “surge” occurring within one hour of landfall.
- Wave run-up causes coastal flooding to commence as much as 6 hours before the eye comes ashore.
  - In spite of the storm’s rapid acceleration.
- Cat 3 surge 10-15 ft in 1938 and Carol
  - Portsmouth - where 20 ft surge is possible!
  - Wareham/Bourne - 22-25 ft surge is possible!


Display Change-Basin Select-Storm Animate Tides Help
: Narragansett/Buzzards Bays <pvd>
Storm: Dir n: Cat 3: 40 mph
Stm Tide
ft NGVD
20
18
16
14
12
10
8
6
4
2
0
Tide level:
0.0 ft
Windham
Providence
Bristol
Plymouth
Kent
Barnstable
New London
Washington
BUZZARD
BAY
Dukes
Block
Island
17.6
16.7
9.7
13.7
13.9
14.8
11.8
14.0
14.3
9.7
9.8
10.8
10.7
11.0
13.2
12.6
13.4
15.0
15.7
16.1
19.4
18.8
9.9
9.2
15.3
9.9
10.1
9.5
9.9
9.8
9.3
7.9
0
25
Slosh Model Storm Surge MEOW
Narragansett/Buzzard's Bay Basins
Simulated Cat 3, moving N at 40 mph

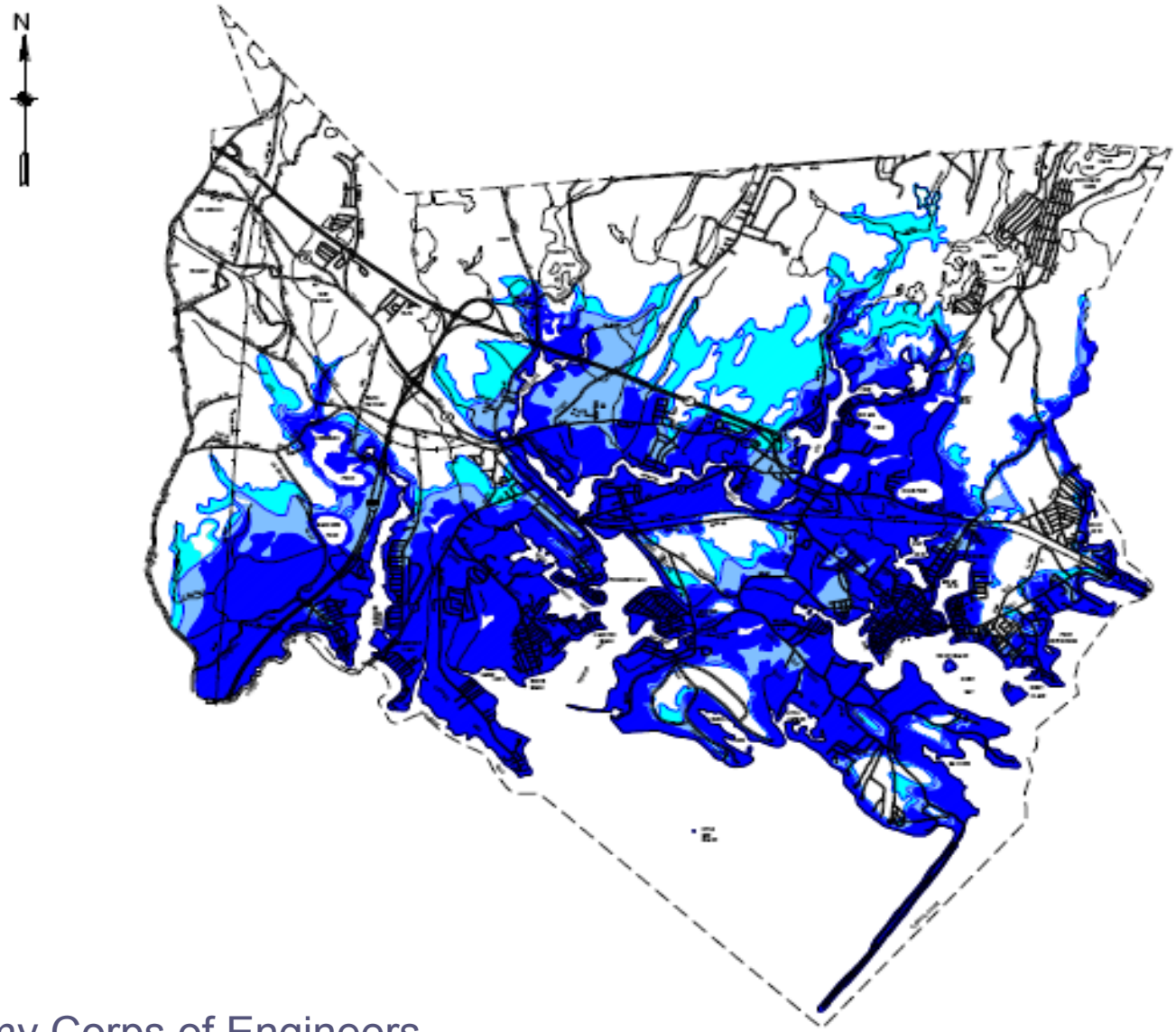
Inundation Atlas Data: Barrington, RI





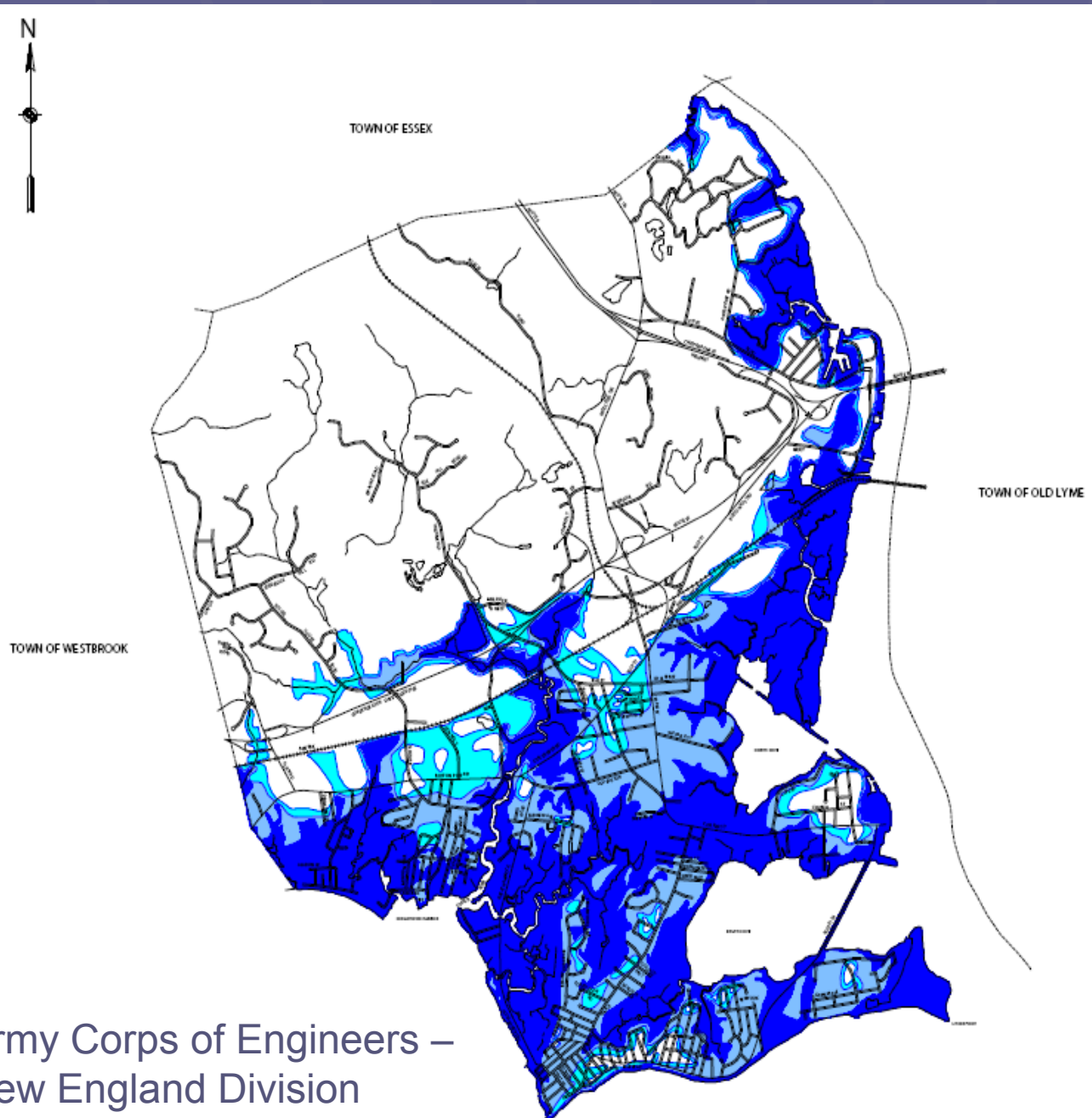
Army Corps of Engineers –
New England Division

Inundation Atlas Data: Wareham, MA



Army Corps of Engineers –
New England Division

Inundation Atlas Data: Old Saybrook, CT



LEGEND

HURRICANE SURGE AREAS

POTENTIAL SURGE AREAS CATEGORY 1 & 2 HURRICANES

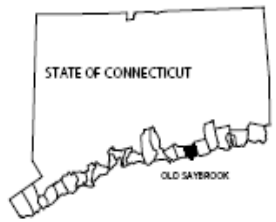
POTENTIAL SURGE AREAS CATEGORY 3 HURRICANES

POTENTIAL SURGE AREAS CATEGORY 4 HURRICANES

NOTES

1. Inundation areas were derived from the national hurricane center's application of the sloshe (sea, lake and overland surges from hurricanes) model. Inundation areas reflect "worst case" combinations of hurricane direction, forward speed, landfall point, and high astronomical tide.
2. Hurricane categories 1 through 4 refer to the saffir-simpson scale of hurricane intensity.
3. Shaded land areas represent areas with coastal flooding potential from hurricane categories referenced in this map legend. Inland areas that may only be subjected to freshwater flooding are not identified.
4. "Worst case" hurricane surge elevations delineated for each inundation area are given in the surge tide profile provided on map 1

LOCATION MAP



STATE OF CONNECTICUT
HURRICANE EVACUATION STUDY
INUNDATION MAP

Army Corps of Engineers –
New England Division

Let's take a trip to the Menauhant section of Falmouth, Massachusetts

Wondering what this might look like during an actual Storm Surge???

Hurricane Bob's Six Foot Storm Surge!

Let's take a trip to the Menauhant section of Falmouth, Massachusetts

What we need to be asking ourselves

- Can we stand on our own feet for 72 hours after a major hurricane strike?
  - Need to be self-sustaining for a period of time before federal resources swing into action
  - The more pre-positioning/planning you do now the less stressful the response will be

What we need to be asking ourselves

- Are we ready to deal with widespread and long duration loss of utilities
  - Utility power could be lost for >3 weeks
    - Consider Gloria – 1985 as a Cat 1 leaving parts of the state without power for over 2 weeks
  - Loss of phone/communication
    - Carol – 1954 took the whole state down
  - Redundancy in communications is a must
    - Landline, satellite, cell, etc
    - Pre-arrange this with the local providers

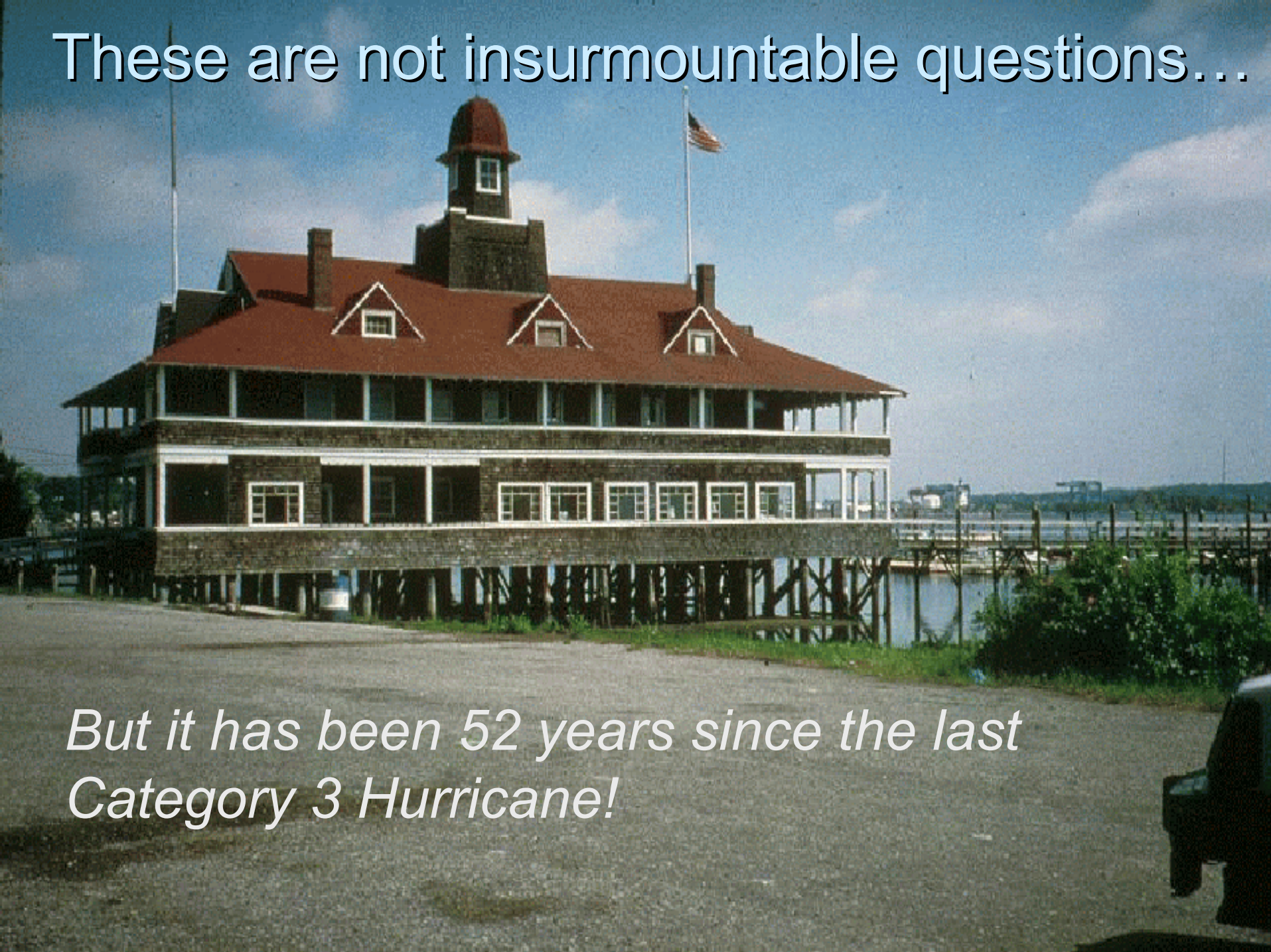
What we need to be asking ourselves

- Are we ready to handle the public safety aspect of all this?
  - Looting has been a problem in the past
  - What about the “explosion” – fire threat?
    - New London, CT was devastated by fire in 1938
  - Roads and bridges washed out
  - Failed Dams
  - Catastrophic losses to the coastline
- How what about home owners who wish to return to their damaged/destroyed property?
- Land use / building code issues after its all over?

What can we do?

Have a family hurricane plan!

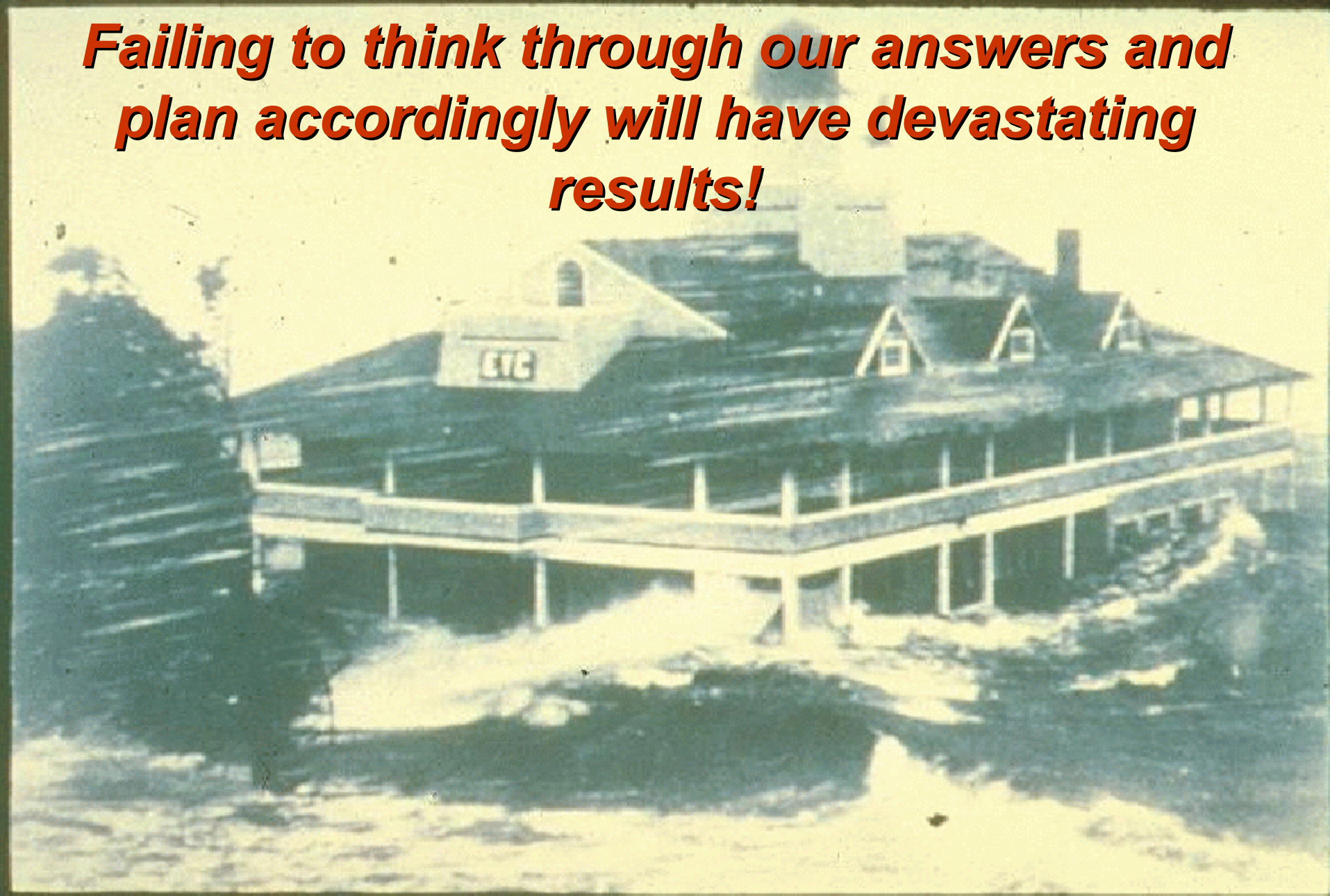
- A plan of actions to take before the storm hits.
- Must account for:
  - Evacuation – if appropriate to you/your family
  - Securing your home and property
  - Safety of your family
    - Food, water, shelter, staying with friends etc.
  - Responsibilities at work
  - Care of elderly friends/relatives in harms way
  - Means of communicating ?


These are not insurmountable questions…
But it has been 52 years since the last Category 3 Hurricane!

Natural Calamity Strikes At About The Time When One Forgets Its Terror!

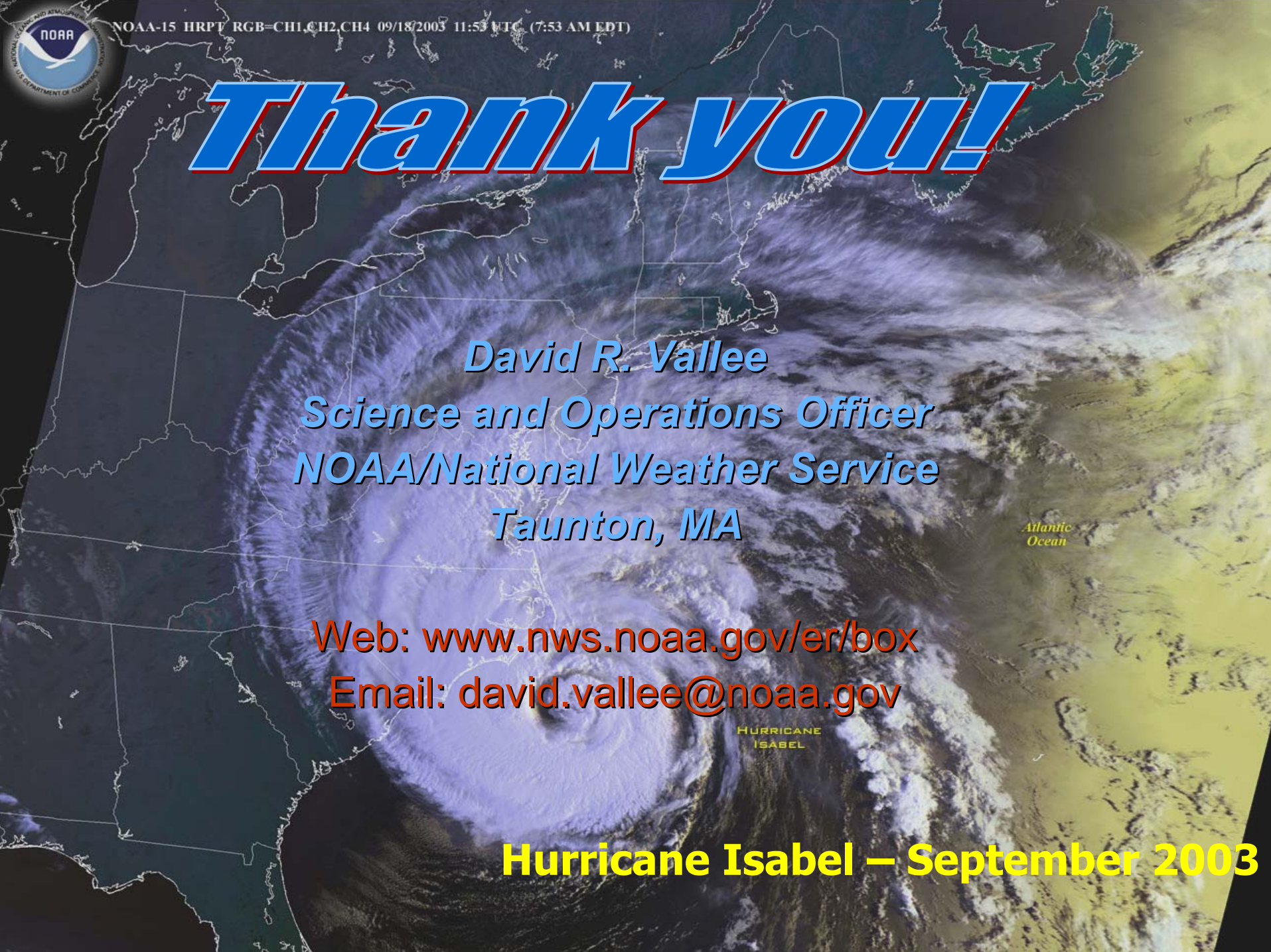
...Japanese Proverb

Failing to think through our answers and plan accordingly will have devastating results!



EDGEWOOD YACHT CLUB - PROVIDENCE R. I.

PROVIDENCE JOURNAL PHOTO



Thank you!

David R. Vallee
Science and Operations Officer
NOAA/National Weather Service
Taunton, MA

Web: www.nws.noaa.gov/er/box
Email: david.vallee@noaa.gov

Hurricane Isabel – September 2003